National Park Service
U.S. Department of the Interior

Air Resources Division

Western Airborne Contaminants Assessment Project

PROJECT OBJECTIVES:

- **Determine if contaminants are present in western national parks**
- **If present, determine where contaminants are accumulating (geographically and by elevation)**
- **If present, determine which contaminants pose a potential ecological threat**
- **Determine which indicators appear to be the most useful to address contamination**
- **Determine the sources for contaminants measured at the national park sites.**

Background

The Western Airborne Contaminants Assessment Project (WACAP) has been initiated to determine the risk to ecosystems and food webs in western national parks from the long-range transport of airborne contaminants. It is being designed and implemented by the National Park Service's Air Resources Division in cooperation with many western national parks, the Environmental Protection Agency, the U.S. Geological Survey, USDA Forest Service, Oregon State University, and University of Washington.

Airborne contaminants can pose serious health threats to wildlife and humans. Some toxic compounds tend to "biomagnify" meaning that small concentrations in air, water, snow, and plants, can result in large concentrations at higher levels of the food chain: like fish, and mammals. Biological effects of airborne contaminants include impacts on reproductive success, growth, behavior, disease, and survival. Subsistence hunters and gatherers in Alaska depend on wild food sources that may be affected by airborne contaminants.

The contaminants of concern are compounds and elements that are sometimes called semi-volatile organic compounds or SOCs. This group contains a variety of persistent organic pollutants (POPs) such as PCBs, DDTs, and HCHs. Elements such as mercury (Hg) are also a concern. These materials are direct or indirect products of human industrial activity and can be transported thousands of miles in the atmosphere. In some cases they can be deposited to aquatic or terrestrial ecosystems and then be re-emitted back into the air to continue their long journey through the atmosphere. Some of these materials have specific properties that permit them to accumulate, preferentially, in colder areas of the global environment. This phenomenon has been termed "cold fractionation" and has been observed for some types of PCBs, HCHs, and even mercury. Hence, it is expected that high elevation and latitude ecosystems may be at greater risk due to the accumulations of these toxic compounds.

Several workshops and a scientific peer review have been conducted since January 2001 to assist in developing this program. As a result, a design has emerged that is centered around seven key national parks in the west representing a latitudinal gradient as well as a coastal to interior gradient. (For WACAP purposes, Gates of the Arctic and Noatak are considered together as one arctic park unit.) Figure 1 (page 2) shows the broad elevation range and average latitude for many national parks in the west. The red bars represent the keystone parks in which all indicators will be sampled. Note that Olympic and Glacier as well as Sequoia and Rocky Mountain National Parks are pairs of western and inland sites located at roughly the same latitude. The green bars represent parks at which a smaller subset of samples will be taken if additional funding is available. At each of the seven park units, two lake catchments will be selected. Samples will be collected at these sites to tell us where and to what extent airborne contaminants have been deposited on these landscapes, and how these contaminants may be distributed within food webs.

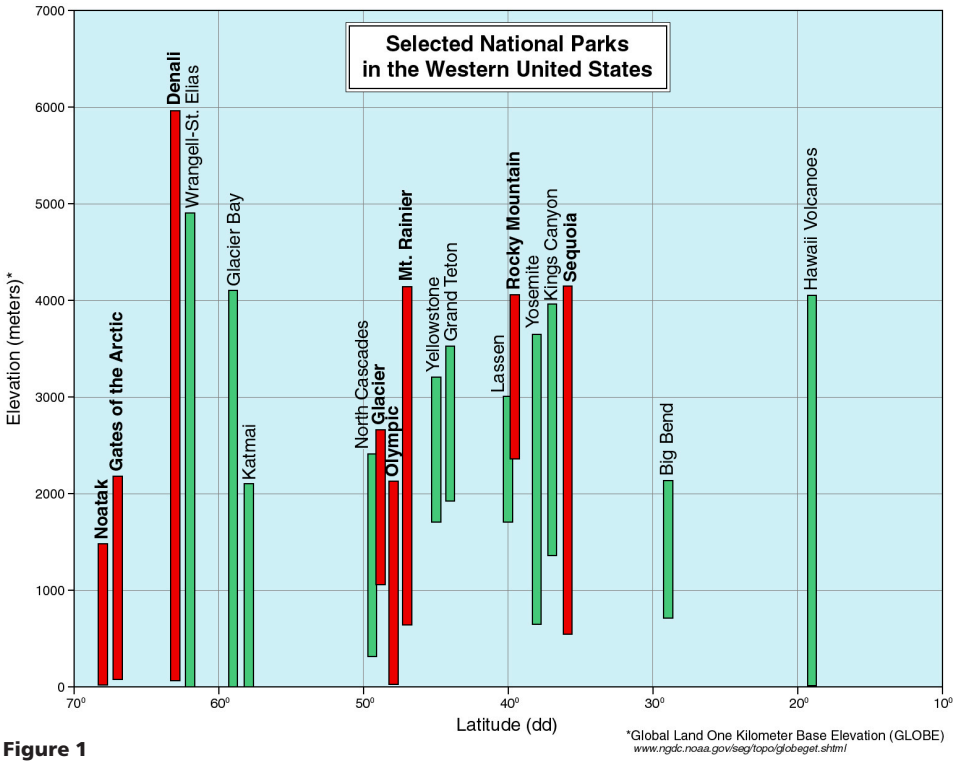

Figure 1

Contaminant Sampling

There are a variety of ecosystem indicators that have been successfully sampled to provide information regarding contaminant accumulation and impacts in terrestrial and aquatic systems. WACAP will collect field samples of the indicators shown in the sidebar (right) and carefully analyze them in state-of-the-art laboratories. Each indicator is paired with some information indicating what the results would tell us about airborne contaminants.

A broad suite of persistent organic pollutants that have been used by humans for decades will be measured such as PCBs, DDTs, DDEs, HCHs, HCB, etc. We will also analyze for the presence of current-use chemicals including pesticides, flame retardants, and others. Mercury is of key interest and will be measured in all materials along with other metals in specific indicators.

The project will take place over a five year period as indicated in the table below:

An interdisciplinary team of scientists including aquatic experts, hydrologists, fisheries biologists, atmospheric specialists, and botanists will work together to interpret the resulting information. A final database and report will be prepared that will provide evidence of the exposure, historical and seasonal trends, and bioaccumulation of air toxic materials in the ecosystems of the western national parks. These data could then be used to assist the parks in selecting approaches and indicators to be used in long-term monitoring efforts aimed at maintaining an ability to detect changes in atmospheric loadings of toxic compounds in the future.

The airborne contaminants project will be a team effort, including not only scientists from a variety of institutions but also resource experts and specialists from each of the participating national parks. Determining where and when to obtain samples will be closely coordinated with NPS personnel and they will be involved in the interpretation of the results. A written research plan was developed in 2002 and a peer review panel met to evaluate the approach and make recommendations for improvements. Information about contaminants in western national parks that is gained from this project will be used to inform the public about the status of contaminant impact to these areas, determine if long-term airborne toxic compounds monitoring is needed, and to develop programs that protect parks from contaminant impacts in the future.

Project Timeline

2002	2003	2004	2005	2006
Pilot studies: design & methods development	Field sampling, chemical analysis, database development, QA/QC, data interpretation			Final databases, interpretive report, and publication

SNOW
Measure of direct atmospheric loading, collected annually, in many alpine cases 90% of the annual precipitation

FISH
Direct measure of food web impacts and food web bioaccumulation

WATER
Measures hydrophilic current-use chemicals

LAKE SEDIMENT
Sediment provides historic trends (~150 yr) of contaminant loading to watershed

LICHEN
Direct measure of food web impacts and metals bioaccumulation

WILLOW BARK
Collected along altitude gradients in all 19 parks, measure of ecosystem exposure, comparisons within and among sites, parks, and elevations

SUBSISTENCE NATIVE FOODS
Direct measure of food sources used by native people (moose)

FOR FURTHER INFORMATION CONTACT:

Chris Shaver, Chief
Air Resources Division
National Park Service
Denver, Colorado
chris_shaver@nps.gov
303-969-2074

ADDITIONAL INFORMATION SOURCES:

NPS Airborne Contaminants Web Site:
www2.nature.nps.gov/ard/aqmon/air_toxics

The European Airborne Contaminants EMERGE Web Site:
www.mountain-lakes.org/index.html